REMARKS

At the time of the Office Action dated August 28, 2002, claims 1-30 were pending in this application. Of those claims, claims 1-18 have been rejected and claims 19-30 have been withdrawn from consideration pursuant to the provisions of 37 C.F.R. § 1.142(b).

Claims 1, 3-4, 7, and 9 have been amended, and claims 2, 5-6 and 14-18 have been cancelled. Care has been exercised to avoid the introduction of new matter. Specifically, claim 1 has been amended by substantially incorporating the limitations of claims 5 and 6 therein, and consequently claims 5 and 6 have been cancelled. Claim 1 has also been amended to recite that a sidewall diffusion barrier layer is formed by reverse sputtering of the first diffusion barrier layer, and this amendment finds adequate descriptive support throughout the originally filed disclosure, for example, in the fourth full paragraph on page 10 of the written description of the specification. Claim 4 has been placed in independent form and amended to recite an upper limit for a second etch stop layer, as supported by the third full paragraph on page 9 of the disclosure. Claims 3, 7 and 9 have been amended to address dependency issues arising from the cancellation of claims 2 and 6. Applicants submit that the present Amendment does not generate any new matter issue.

In the second enumerated paragraph of the Office Action, the Examiner objected to claim 15. However, as claim 15 has been cancelled, the Examiner's objection to claim 15 is moot.

Claims 1-3, 5, 9-12, 14-15 and 17 are rejected under 35 U.S.C. § 102(b) for lack of novelty as evidenced by Huang, U.S. Patent No. 6,156,648 (hereinafter Huang)

In the third enumerated paragraph of the Office Action, the Examiner asserted that Huang discloses a semiconductor device corresponding to that claimed. This rejection is respectfully traversed.

Initially, Applicants note that claim 1 has been amended. As such, Applicants will discuss the distinguishing characteristics of claim 1, as amended, with regard to the teachings of Huang.

Claim 1, as amended, recites that a sidewall diffusion barrier is formed on sidewalls of a via. Claim 1 also recites that the sidewall diffusion barrier layer is formed by reverse sputtering of the first diffusion barrier layer. Thus, the sidewall diffusion barrier layer is formed from the same material as that of the first diffusion barrier layer. Huang, however, teaches that the barrier spacer 218a is formed by "etching back" (column 3, lines 50-54). Thus, the structure provided by the reverse sputtering of the first diffusion barrier layer, as recited in claim 1, is not disclosed by Huang. Furthermore, Huang teaches that the cap layer 204 is formed from silicon nitride (column 3, line 30) and the barrier is formed from tantalum nitride (column 3, lines 46-47) with these features being asserted by the Examiner as respectively comparable to the claimed first diffusion barrier layer and sidewall diffusion barrier layer. However, whereas Huang shows that these two features are formed from different materials, claim 1 recites that these features are formed from the same material. As such, Huang fails to identically describe all the limitations recited in claim 1 within the meaning of 35 U.S.C. § 102. Therefore, Applicants respectfully request the withdrawal of the rejection of claims 1, 3 and 9-12 under 35 U.S.C. § 102 in view of Huang.

Claims 14-17 are rejected under 35 U.S.C. § 102(b) for lack of novelty as evidenced by Geffken et al., U.S. Patent No. 5,985,762 (hereinafter Geffken)

In the fourth enumerated paragraph of the Office Action, the Examiner asserted that Geffken discloses a semiconductor device corresponding to that claimed. As claims 14-17 have been cancelled, this rejection is moot.

Claim 4 is rejected under 35 U.S.C. § 103 for obviousness predicated upon Huang

In the fifth enumerated paragraph of the Office Action, the Examiner asserted that Huang shows most aspects of the claimed invention and one having ordinary skill in the art would have been motivated to "form the second etch stop layer of Huang having a thickness as claimed because it is obvious to form the layer having a sufficient thickness to function as an etch stop to prevent layers formed below it to further etching." This rejection is respectfully traversed.

The Examiner has the burden of identifying a source in the applied prior art for each claim limitation and identifying a source for the requisite realistic motivation to modify a particular reference in a particular manner to arrive at a specifically claimed invention. **Smiths Industries Medical System v. Vital Signs Inc.**, 183 F.3d 1347, 51 USPQ2d 1415 (Fed. Cir. 1999); **In re Mayne**, 104 F.3d 1339, 41 USPQ2d 1451 (Fed. Cir. 1997). The Examiner, however, has not established where the prior art teaches the motivation asserted above. Instead, the Examiner's asserted motivation is very similar to page 9, lines 20-21 of Applicants' disclosure. In this regard, the Examiner is reminded that Applicants' disclosure cannot be properly relied upon by the Examiner to support the ultimate legal conclusion of obviousness under 35 U.S.C. § 103. **Panduit Corp. v. Dennison Mfg. Co.**, 774 F.2d 1082, 227 USPQ 337 (Fed. Cir. 1985).

Notwithstanding the Examiner's failure to establish a proper motivation to modify the "second etch stop layer" of Huang, the Examiner's asserted second etch stop layer is described in Huang as a dielectric layer 206. One having ordinary skill in the art would readily recognize that by using the term "dielectric layer," Huang does not disclose that layer 206 is an etch stop layer. This is supported by the Examiner using a different term, stop layer 208, to refer to an etch stop layer. The misidentification of the dielectric layer 206 of Huang as an etch stop layer is a result, in part, of the Examiner's failure to construe meanings for the terms "dielectric layer" and "etch stop layer" and to identify the differences between these two terms.[1]

As is known to those having ordinary skill in the art, dielectric layers typically have thicknesses measured in the thousands of angstroms. In contrast, the thickness of the claimed second etch stop layer is at least 50 angstroms to about 120 angstroms. This extreme difference in thicknesses is indicative of the difference between the second etch stop layer of the claimed invention and the dielectric layer 206 of Huang. The etch stop layer of the claimed invention is what it is claimed to be (i.e., an etch stop). In contrast, the dielectric layer 206 is what is commonly known as an interlayer dielectric layer (ILD). Thus, one having ordinary skill in the art would not have been motivated to modify the dielectric layer 206 of Huang in a manner that would render the dielectric layer 206 unsuitable for the purpose for which it was intended. Therefore, Applicants respectfully submit that one having ordinary skill in the art at the time of the invention would not have found the claimed invention, as recited in claim 4, obvious in view of Huang.

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[1] As part of a prima facie analysis of obviousness, the Examiner is to construe each term in the claim consistent with the specification. See 37 C.F.R. § 1.56(b)(2)(ii). This allows Applicants fair opportunity to evaluate the teachings of the applied prior, as compared to the claimed invention. As discussed in M.P.E.P. § 706.02(j), "[it] is important for an

Claims 6-8 and 16 are rejected under 35 U.S.C. § 103 for obviousness predicated upon Huang in view of Geffken

In the sixth enumerated paragraph of the Office Action, the Examiner asserted that Huang shows most aspects of the claimed invention and Geffken discloses a sidewall diffusion barrier and a first diffusion barrier layer formed from the same material. The Examiner then concluded that one having ordinary skill in the art would have been motivated to combine Huang in view of Geffken to arrive at the claimed invention. This rejection is respectfully traversed.

As claim 6 has been incorporated in part into claim 1, Applicants will address the Examiner's rejection as to claim 6 as the rejection applies to claim 1. Initially, Applicants note that neither Geffken nor Huang teach or suggest that the sidewall diffusion barrier layer is formed by reverse sputtering of the first diffusion barrier layer. The process of reverse sputtering provides a different structure for the sidewall diffusion barrier layer than the structures disclosed by Geffken or Huang. Specifically, the thickness of the sidewall diffusion barrier layer decreases in a direction away from the first diffusion barrier layer.

Applicants also note that Geffken does not teach that the first diffusion barrier layer and the sidewall diffusion barrier layer are formed from the same material, as recited in claim 1. Instead, Geffken shows the silicon nitride barrier 22 and the barrier layer 28 both being formed from silicon nitride. However, as discussed in column 1, lines 38-43 of Geffken, several other materials are suitable for use as a diffusion barrier layer. Thus, the disclosure by Geffken of the silicon nitride barrier 22 and the barrier layer 28 both being formed from silicon nitride is nothing more than chance and not a teaching of the limitation recited in claim 1.

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examiner to properly communicate the basis for a rejection so that the issues can be identified early and the applicant can

Furthermore, there is no teaching in Geffken that would lead one having ordinary skill in the art to form both the first diffusion barrier layer and the sidewall diffusion barrier layer from the same material. In the Office Action, the Examiner asserted that the motivation to combine Geffken with Huang is "to simplify the process step." This teaching, however, cannot be found in Geffken. As previously stated, the requisite motivation to combine references must be found in the applied prior art. Additionally, the Examiner is not free to conjure from thin air the requisite motivation to combine. As there is no apparent motivation to modify Huang in view of Geffken, Applicants respectfully solicit the withdrawal of the rejection of the claims under 35 U.S.C. § 103 for obviousness predicated upon Huang in view of Geffken.

Claims 13 and 18 are rejected under 35 U.S.C. § 103 for obviousness predicated upon Huang in view of Taniguchi, U.S. Patent No. 5,847,459

In the seventh enumerated paragraph of the Office Action, the Examiner asserted that one having ordinary skill in the art would have been motivated to modify Huang in view of Taniguchi to arrive at the claimed invention. This rejection is respectfully traversed.

Applicants incorporate herein the arguments previous presented with regard to claim 1, upon which claim 13 directly depends. Specifically, Huang fails to teach or suggest that the sidewall diffusion barrier layer is formed by reverse sputtering of the first diffusion barrier layer. The secondary reference of Taniguchi does not cure the argued deficiencies of Huang. As such, even if Taniguchi and Huang were combined, the claimed invention would not result. As such, Applicants respectfully solicit the withdrawal of the rejection of claim 13 under 35 U.S.C. § 103.

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be given fair opportunity to reply."

Claim 18 is rejected under 35 U.S.C. § 103 for obviousness predicated upon Geffken in view of Taniguchi, U.S. Patent No. 5,847,459

In the seventh enumerated paragraph of the Office Action, the Examiner asserted that one having ordinary skill in the art would have been motivated to modify Geffken in view of Taniguchi to arrive at the claimed invention. As claim 18 has been cancelled, this rejection is moot.

Based upon the arguments submitted supra, it should be apparent that a prima facie basis to deny patentability to the claimed invention has not been established for want of the requisite factual basis and lack of the requisite realistic motivation. Moreover, there are potent indicia of nonobviousness of record which undermine the Examiner's obviousness conclusion.

Specifically, Applicants have discovered the source of the problem of copper contamination of trench/vias during rounding of corners of the trench/via corners by reverse sputtering. It is well settled that the recognition of the source of a problem constitutes evidence of nonobviousness. **In re Sponnoble**, 405 F.2d 578, 160 USPQ 237 (CCPA 1969). Moreover, it is well settled that the problem addressed and solved by a claimed invention must be given consideration in resolving the ultimate legal conclusion of obviousness under 35 U.S.C. § 103. **North American Vaccine, Inc. v. American Cyanamid Co.**, 7 F.3d 1571, 28 USPQ2d 1333 (Fed. Cir. 1993); **Northern Telecom, Inc. v. Datapoint Corp.**, 908 F.2d 931, 15 USPQ2d 1321 (Fed. Cir. 1990); **In re Nomiya**, 509 F.2d 566, 184 USPQ 607 (CCPA 1975). The present invention addresses and solves the problem of contamination from a metallization layer, such as copper, during rounding of corners by providing a barrier layer above the metallization layer. As such, during the reverse sputtering process, material from the barrier layers is redeposited on

walls of the via and this redeposited layer prevents subsequent contamination caused by reverse sputtering of the metallization layer. None of the applied prior art express any recognition of the problem much less offer any viable solution thereof. Under such circumstances, the problem addressed and solved by the claimed invention constitutes a potent indicium of nonobviousness which must be given consideration regarding the ultimate legal conclusion of nonobviousness under 35 U.S.C. § 103.

Attached hereto is a marked-up version of the changes made to the claims by the current amendment. The attached page is captioned "Version with markings to show changes made."

Applicants have made every effort to present claims which distinguish over the prior art, and it is believed that all claims are in condition for allowance. However, Applicants invite the Examiner to call the undersigned if it is believed that a telephonic interview would expedite the prosecution of the application to an allowance. Accordingly, and in view of the foregoing remarks, Applicants hereby respectfully request reconsideration and prompt allowance of the pending claims.

To the extent necessary, a petition for an extension of time under 37 C.F.R. § 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 500417, and please credit any excess fees to such deposit account.

Respectfully submitted,

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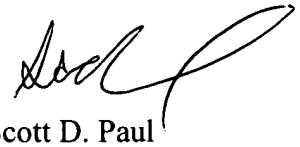

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Version with markings to show changes made

IN THE CLAIMS:

Please cancel claims 2, 5, 6 and 14-18 in their entirety without prejudice or disclaimer of the subject matter amend claims 1, 3, 4, 7 and 9 as follows:

1. (Amended) A semiconductor device, comprising:

a first metallization layer;

a first diffusion barrier layer disposed over said first metallization layer;

a first etch stop layer disposed over and spaced from said first diffusion barrier layer;

a dielectric layer disposed over said second etch stop layer; [and]

a via extending through said dielectric layer, said first etch stop layer, and said first diffusion barrier layer; and

a sidewall diffusion barrier layer disposed on sidewalls of said via, said sidewall diffusion barrier layer formed by reverse sputtering of said first diffusion barrier layer, wherein said sidewall diffusion barrier and said sidewall diffusion barrier layer are formed from a same material.

3. (Amended) The semiconductor device according to claim [2] 4, wherein said second etch stop layer includes silicon oxide

4. (Amended) [The] A semiconductor device [according to claim 3], comprising:

a first metallization layer;

a first diffusion barrier layer disposed over said first metallization layer;

a second etch stop layer disposed on and contacting said first metallization layer;

a first etch stop layer disposed on and contacting said second etch stop layer;

a dielectric layer disposed on and contacting said first etch stop layer;

a via extending through said dielectric layer, said first etch stop layer, said second etch stop layer and said first diffusion barrier layer, wherein said second etch stop layer has a thickness of at least 50 angstroms to about 120 angstroms.

7. (Amended) The semiconductor device according to claim [6] 1, wherein said material of said first diffusion barrier layer includes silicon nitride.

9. (Amended) The semiconductor device according to claim [5] 1, further comprising a second diffusion barrier layer disposed over said sidewall diffusion barrier layer.